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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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June 1970

U.S. Training and
Employment Service
Technical Report
S-344R

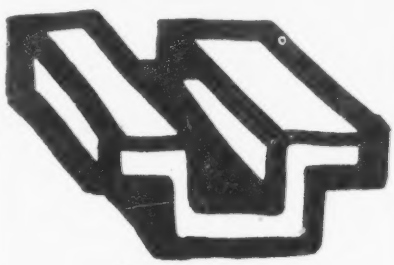
Development of USTES

APTITUDE TEST
BATTERY FOR

STRUCTURAL-STEEL LAY-OUT MAN

(any ind.)
809.381

U.S. DEPARTMENT OF LABOR
Manpower Administration



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Technical Report on Development of USTES Aptitude Test Battery

For . . . . . .

Structural-Steel Lay-Out Man (any ind.) 809.381-030

S-344R

(Developed in Cooperation with the
Pennsylvania State Employment Service)

U.S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2552

Development of USTES Aptitude Test Battery

For

Structural-Steel Lay-Out Man (any ind.) 809.381-030

S-344R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Structural-Steel Lay-Out Man (any ind.) 809.381-030. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
S - Spatial Aptitude	100
P - Form Perception	95
Q - Clerical Perception	90

RESEARCH SUMMARY

Sample:

50 male trainees being trained as Structural-Steel Lay-Out Men in Pennsylvania.

This study was conducted prior to the requirement of providing minority group information. Therefore, minority group composition is unknown.

Criterion:

Instructors' ratings.

Design:

Longitudinal (trainees were tested prior to training and criteria were collected after the completion of training).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Predictive Validity:

Phi coefficient = .41 ($P/2 < .005$)

Effectiveness of Norms:

Only 62% of the nontest-selected trainees used for this study were good trainees; if the trainees had been test-selected with the above norms, 80% would have been good trainees. 38% of the nontest-selected trainees used for this study were poor trainees; if the trainees had been test-selected with the above norms, only 20% would have been poor trainees. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Trainees	62%	80%
Poor Trainees	38%	20%

SAMPLE DESCRIPTION

Size:

N = 50

Occupational Status:

Trainees

Work Setting:

Trainees were being trained at Canon-McMillan Senior High School in Canonsburg, Pennsylvania.

Employer Selection Requirements:

Education: High school graduation or GED equivalent diploma.

Previous Experience: None

Tests: None

Principal Activities:

The job duties for the occupation for which these individuals were being trained are comparable to those shown in the job description in the Appendix.

Minimum Training:

Each trainee at the time of criterion collection had completed 20 weeks (600 hours) of instruction in basic mathematics, blueprint reading and drafting.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age and Education

	Mean	SD	Range	r
Age (years)	28.8	6.3	21-49	-.118
Education (years)	11.6	1.2	7-15	.387

EXPERIMENTAL TEST BATTERY

All the tests of the GATB, B-1002B, were administered during the period November 1962 and February 1964.

Criterion

The criterion consisted of instructors' ratings based on courses in blueprint reading, drafting and basic mathematics. The ratings were made at the end of the training course by three instructors. The pooled ratings of the three instructors divided the trainees into three groups: (1) excellent, (2) good and (3) poor.

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 38% of the sample in the low group to correspond with the percentage of trainees considered unsatisfactory or marginal. Trainees in the high criterion group were designated as "good trainees" and those in the low group as "poor trainees."

Aptitudes Considered for Inclusion in the Norms

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitude M which does not have a significant correlation with the criterion was considered for inclusion in the norms because the qualitative analysis indicated that this aptitude was important for job duties and the sample had a relatively high mean score on this aptitude. Tables 3, 4 and 5 show the results of the qualitative and quantitative analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

G - General Learning Ability	Required to read and interpret blueprints; to learn basic mathematical skills; to acquire a knowledge of projection.
N - Numerical Aptitude	Required for the application of arithmetical and mathematical knowledge to properly locate and mark for cuts, rivet holes and bends.
S - Spatial Aptitude	Required to read and interpret blueprints; to interpret, analyze, solve and make free sketches and instrument technical drawings; to be able to think in terms of geometric forms.
P - Form Perception	Required to trace identical lay-outs from pattern to workpiece; to make location of rivet holes, cuts, and bends; to check own work for accuracy and consistency.
M - Manual Dexterity	Required to handle and manipulate a variety of measuring instruments and devices.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB. N = 50

G - General Learning Ability	106.0	14.4	69-142	.544**
V - Verbal Aptitude	97.2	13.9	73-140	.350*
N - Numerical Aptitude	109.3	13.7	80-156	.385**
S - Spatial Aptitude	106.3	15.7	61-137	.428**
P - Form Perception	107.8	15.7	78-154	.386**
Q - Clerical Perception	104.1	13.2	80-138	.486**
K - Motor Coordination	108.8	17.6	49-148	.187
F - Finger Dexterity	96.7	18.0	44-137	.036
M - Manual Dexterity	115.4	19.4	55-162	.256

*Significant at the .05 level

**Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data: Important	X		X	X	X				X
Irrelevant									
Relatively High Mean			X		X		X		X
Relatively Low Standard Deviation	X	X	X			X			
Significant Correlation with Criterion	X	X	X	X	X	X			
Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q			M

DERIVATION AND VALIDITY OF TEST NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, S, P, Q and M at trial cutting scores were able to differentiate between the 62% of the sample considered to be good trainees and the 38% of the sample considered to be poor trainees. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The phi coefficient was used as a basis for comparing trial norms. Norms of S-100, P-95, and Q-90 provided optimum differentiation for the occupation of Structural-Steel Lay-Out Man (any ind.) 809.381-030. The validity of these norms is shown in Table 6 and is indicated by a phi coefficient of .41 (statistically significant at the .005 level).

TABLE 6

Predictive Validity of Test Norms
S-100, P-95, and Q-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Trainees	7	24	31
Poor Trainees	13	6	19
Total	20	30	50

Phi coefficient = .41 Chi square (X^2_y) = 8.5
Significance Level = P/2 $<$ .005

Determination of Occupational Aptitude Pattern

The data for this study met the requirements for incorporating the occupation studied into OAP-34 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .25 is obtained with the OAP-34 norms of N-90, S-95 and P-90.

FACT SHEET

Job Title: Structural-Steel Lay-Out Man (any ind.) 809.381-030

Job Summary: Makes true and accurate lay-outs on structural steel. Performs duties such as determining location of rivet holes, cuts and bends, checking measurements for accuracy, and utilizing knowledge of basic mathematics and projections. Must be able to use a variety of precision measuring instruments and devices.

Work Performed: Lays out location of holes, cuts and bends on structural iron and steel, and sheet-metal from blueprints or templates. Studies blueprints, or lays template on metal section and marks location of holes, cuts and lines, using soapstone pencil, scriber, straight-edge, rulers, compass, etc. May lay out templates (a pattern made of wood, light sheet-metal, or cardboard, used as a guide in laying out several identical workpieces to insure accuracy and consistency of the product).

Studies blueprint to determine location of rivet holes, cuts, and bends, and to fix in mind what finished lay-out will look like. Establishes first reference point on workpiece, from which point all other measurements will be made to locate holes, cuts or bends. Uses chalk or soapstone pencil to mark these locations. Hole centers are established and marked with prick punch for subsequent drilling.

Following completion of lay-out rechecks all measurements against blueprint to insure accuracy. In case several identical lay-outs are to be made, may make a template (of wood, heavy cardboard, or light-guage sheet-metal) which is laid on the workpiece and all markings and reference points traced directly from pattern (template) to workpiece.

Lay-out men are responsible for making true and accurate lay-outs on structural steel directly from blueprints, and must be able to check own work for accuracy.

Must be able to read blueprints, and employ his knowledge of mathematics and projections to properly locate and mark for cuts, rivet holes, and bends. Must be accurate in the use of scales and rules to maintain tolerance of 1/32" on the completed lay-out.

Effectiveness of Norms: Only 62% of the nontest-selected trainees used for this study were good trainees; if the trainees had been test-selected with the S-344R norms, 80% would have been good trainees. 38% of the nontest-selected trainees used for this study were poor trainees; if the trainees had been test-selected with the S-344R norms, only 20% would have been poor trainees.

Applicability of S-344R Norms: The aptitude test battery is applicable to jobs which include a majority of job duties described above.

GPO 899.426

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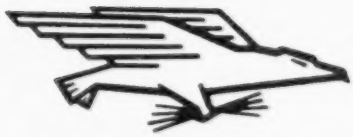

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